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Description and Surface Topography of a Larval Didymozoid (Trematoda) from *Apogon uninotatus* (Apogonidae) in Kuwait Bay

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ABSTRACT: A new larval didymozoid (Trematoda: Didymozoidae) was found in the stomach of the cardinalfish, *Apogon uninotatus,* in Kuwait Bay. The larva is characterized by the presence of a "stomach" and relatively short moniliform ceca comprising 6 chambers. The surface microtopography of the larva is basically similar to that of other digenean metacercariae. The larval surface is folded into a complex network of interconnecting lamellae. Only domed papillae were observed, presumably sensory organs. No spines were observed on the body tegument. The observed microtopographical features possibly facilitate migration in the definitive host tissue.
KEY WORDS: Trematoda, Digenea, Didymozoidea, larva, *Apogon uninotatus,* scanning electron microscopy, Kuwait Bay.

Didymozoids are tissue-dwelling parasites of marine predatory fishes (reviewed by Nikolaeva, 1985). The taxonomic position of this unique group of trematodes is debatable and the life cycles are obscure, although the larvae are known to occur in the alimentary tract and body muscles of a variety of invertebrates and small fishes. The small fishes presumably act as third intermediate host, acquiring the infection by ingesting infected crustacean second intermediate hosts or planktonic invertebrate paratenic hosts. Infection of the definitive host probably occurs by ingestion of infected small fishes. It is not known whether or not molluscs are involved in the life cycles of didymozoids, although this seems likely.

In this study, a new didymozoid larva from the stomach of *Apogon uninotatus* in Kuwait Bay was described, and its surface topography was examined by scanning electron microscopy (SEM).

Materials and Methods

Among fishes collected from intertidal pound-traps in Kuwait Bay, approximately 20 km west of Kuwait City, 10 specimens of *Apogon uninotatus* (Apogonidae), 6–10 cm long, harbored didymozoid larvae. Living larvae recovered from stomachs of the fish were washed in 0.7% saline and either prepared for light microscopy (LM) or SEM. For LM, larvae were fixed in alcohol-formalin-acetic acid, stained in Mayer's acid carmine or Ehrlich's hematoxylin, and mounted in Canada balsam. The larva was drawn with the aid of a camera lucida. Measurements were taken from stained specimens and are given in micrometers with averages in parentheses. For SEM, larvae were fixed for 1 hr in cold 2.0% glutaraldehyde buffered to pH 7.4 with 0.1 M sodium cacodylate. The larvae were then washed several times, postfixed for 10 min in cold 1% osmium tetroxide in the same buffer, and dehydrated in acetone. Larvae suspended in acetone were dried in a Technics critical-point drying apparatus using liquid CO_2 as a transitional medium. The larvae were sputter-coated with gold-palladium and viewed under a JEOL JSM-840 scanning electron microscope at an accelerating voltage of 15 kV. Approximately 50 larvae were examined in this study.

Results

Didymozoidae Poche, 1907

Immature larva

Description

TYPE HOST: *Apogon uninotatus* Smith and Radcliffe.

SITE OF INFECTION: Stomach.

TYPE LOCALITY: Doha, Kuwait Bay.

DATE OF COLLECTION: March 1989.

SPECIMENS: Deposited in the helminth collections of the Department of Zoology, University of Kuwait, and CAB International Institute of Parasitology, No. S-1087.

Diagnosis

Description, based on 7 specimens (Fig. 1): body slender 580.0–1180.0 (783.8) by 80.0–130.0 (108.8). Eyespots absent. Oral sucker 47.5–62.5 (56.7) by 25.0–52.5 (44.3), pyriforms entirely muscular. Pharynx 12.5–15.0 (13.6) by 10.0–15.0 (13.3). Ventral sucker 62.5–75.0 (68.2) by 57.5–70.0 (62.5); 15.00-34.0 (21.6) from anterior end of body. Esophagus sinuous, 130.0–177.5 (156.7) long. Stomach 37.5–85.0 (56.6) by 32.5–55.0 (42.9), thick-walled, surrounded by gland cells. Ceca each composed of 6 dilated, thin-walled chambers sequentially becoming larger, terminating at different levels. Excretory vesicle

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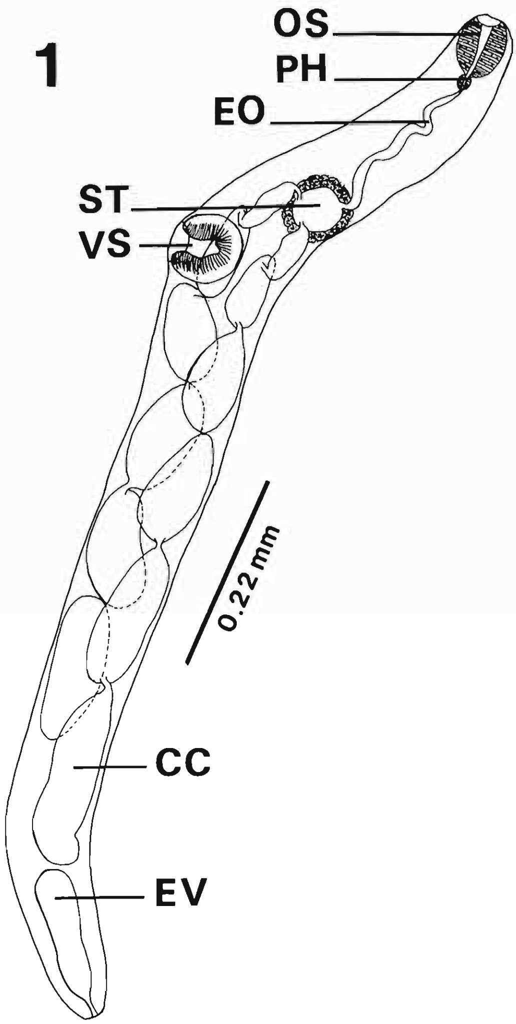


Figure 1. A didymozoid larva from *Apogon uninotatus*. CC = cecal chamber, EO = esophagus, EV = excretory vesicle, OS = oral sucker; PH = pharynx, ST = stomach; VS = ventral sucker.

postcecal 60.0–140.0 (108.0) by 25.0–67.5 (44.6), pore terminal.

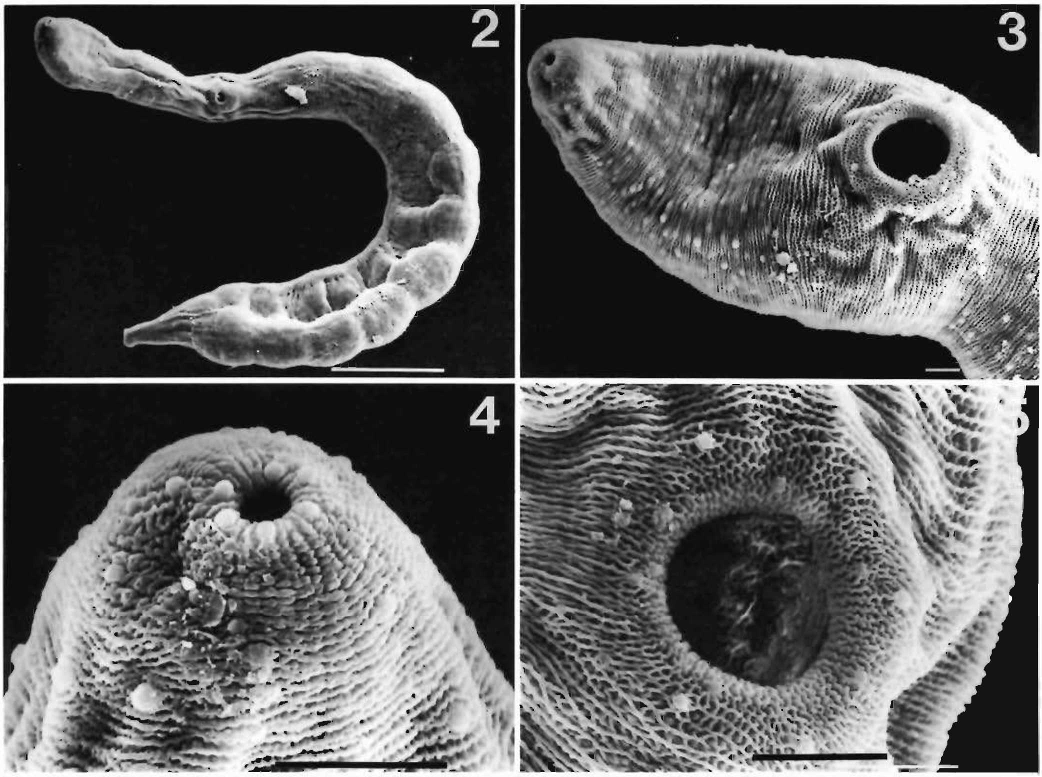
Surface microtopography

The body of the larva can be divided into 3 parts based on the body shape and microtopography (Fig. 2): (1) dorsoventrally flattened to subcylindrical forebody from the oral sucker to the ventral sucker region, (2) laterally expanded hindbody, and (3) sharply tapered short posterior part resembling the ecsoma of hemiurids. The prominence of this division depends on the state of muscular contraction. Domed papilla are concentrated on the ventral and lateral aspects of the body, particularly in the region between the suckers (Figs. 3, 4, 7). The oral sucker is subterminal, surrounded by 6 domed papillae (Fig. 4). The ventral sucker is surrounded by 2 circles of domed papillae, each with 6 papillae radially arranged on the outer margin of the sucker (Fig. 5). The forebody and the hindbody bear a series of circumferentially oriented ridges. Within the oral and ventral suckers, the ridges are arranged radially (Figs. 4, 6). The tegument of the posterior part of the larva is distinctly separated from the general pattern of the body by longitudinally oriented ridges (Fig. 8). At high magnification, tegumental ridges appear as a complex network of interconnecting lamellae changing in appearance according to state of body contraction (Figs. 9, 10). An invagination, the opening of the excretory pore, is observed at the posterior end of the larva (Fig. 8). No spines or ciliated papillae were observed on the tegument.

Discussion

Species of larval didymozoids with "stomach" and moniliform ceca have been reported from a variety of small fishes in tropical and subtropical waters (Yamaguti, 1942, 1970, 1975; Fischthal and Kuntz, 1964; Nikolaeva, 1965, 1970; Fischthal and Thomas, 1968; Madhavi, 1968; Kurochkin and Nikolaeva, 1978; Køie and Lester, 1985). The present species is characterized by the presence of a relatively short cecum with small number of chambers. It is most similar to immature didymozoid species 1 recovered from several species of small fishes in Moreton Bay, Queensland, Australia (Køie and Lester, 1985) and a didymozoid metacercaria from a copepod in Bay of Bengal (Madhavi, 1968). However, the former has 5 cecal chambers and the latter lacks a pharynx. This report is the second on larval didymozoids from fish in Kuwait Bay. Abdul-Salam et al. (1990) described a new species from *Nemipterus peronii,* which differs from the present species in anatomical and topographical features.

Several attempts have been made to develop a scheme for the classification of larval didymozoids (Nikolaeva, 1965; Yamaguti, 1970, 1975; Kurochkin and Nikolaeva, 1978). However, the proposed schemes were not successful because they were based on extremely variable criteria that change with age such as body size, ratio of body length to width, distance between

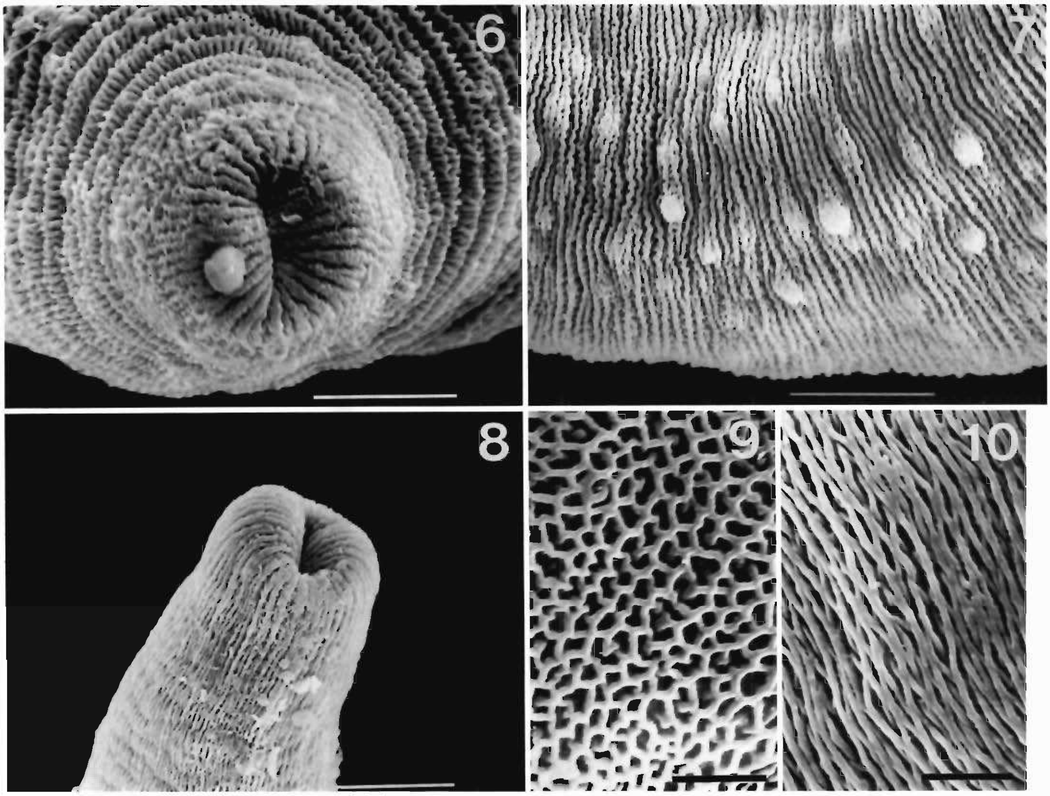


Figures 2–5. Scanning electron micrographs of a didymozoid larva from *Apogon uninotatus*. 2. Whole view, ventral surface showing dorsoventrally flattened forebody bearing oral and ventral suckers, laterally expanded hindbody showing cecal chamber impressions, and sharply pointed posterior part. Scale bar = 100 μm. 3. Forebody, ventral view showing oral sucker, ventral sucker and papillar distribution. Scale bar = 10 μm. 4. Anterior end, showing papillar distribution on and around oral sucker. Scale bar = 10 μm. 5. Ventral sucker surrounded by concentrically arranged domed papillae. Scale bar = 10 μm.

suckers, shape of the digestive tract, and species of host. Køie and Lester (1985) concluded that with the present knowledge it is impossible to classify the larval didymozoids to generic or higher taxonomic levels. SEM studies on surface topography of larval didymozoids, in particular, number and distribution of papillae on the sucker(s), may introduce reliable taxonomic features. LM investigations on other species of trematodes have demonstrated that papillar arrangement remains constant during development (Goodchild, 1943; Thomas, 1958). Fischthal (1951) made considerable use of papillar arrangement in the taxonomy of rhopalocercariae, and Bakke and Lien (1978) suggested the use of SEM images of papillar arrangement in the oral sucker as a basis for the taxonomy of *Phyllodistomum* species.

Although it is not possible to associate the larval didymozoid reported herein with any adult didymozoids, it is of interest to note that SEM images of the posterior part of the larva show a structure resembling the ecsoma of hemiurids described in *Neometadidymozoon helicis* (Lester, 1979). The presence of such a structure in a larval didymozoid lends support to the view that didymozoids are digenetic trematodes related to the hemiurids (Cable, 1974; Brooks et al., 1985).

The surface topography of the didymozoid larvae did not differ essentially from that of other digenean metacercariae examined by SEM (Køie, 1985). The most distinctive characteristics of the tegument are the extensive formation of ridges covering the entire body, concentration of domed papillae on the ventral surface, particularly around the suckers, and absence of spines or ciliated sensory structures. The highly ridged tegumental surface of the larva possibly allows greater strength and flexibility essential during



Figures 6–10. Scanning electron micrographs of a didymozoid larva from *Apogon uninotatus*. 6. Invaginated ventral sucker showing pattern of tegumental ridges. Scale bar = 10 μm. 7. Body tegument showing circumferentialy oriented ridges and papillae. Scale bar = 10 μm. 8. Posterior part showing terminal invagination of the excretory pore and longitudinally oriented tegumental ridges. Scale bar = 10 μm. 9. High magnification of tegumental ridges in stretched state. Scale bar = 4 μm. 10. High magnification of tegumental ridges in contracted state. Scale bar = 4 μm.

migration in cavities and tissues of the paratenic or definitive host. Comparable patterns of ridges have been observed on the surface of juvenile *Schistosoma mansoni,* and it has been suggested that they facilitate increase in size and volume of the worm during growth and provide flexibility during movement (Voge et al., 1978; Crabtree and Wilson, 1980; Basch and Basch, 1982). The domed papillae present on the tegument of the didymozoid larva are similar in structure to those described in other larval and adult digeneans (Smyth and Halton, 1983). From their structure and location, they could have a mechanoreceptive function involved in orientation during larval migration in the definitive host tissue.

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Obituary Notice

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